5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Solanum incompletum* (pōpolo kū mai)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2023. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status reviews for 133 Species in Oregon, Washington, Idaho, Montana, California, Hawaii, Guam, and the Northern Mariana Islands . Federal Register 88(56): 17611–17614, March 23, 2023.

Lead Region/Field Office:

Region 1/Pacific Islands Fish and Wildlife Office (PIFWO), Honolulu, Hawai‘i

Name of Reviewer:

Daniel Adamski, Biologist, PIFWO
Lauren Weisenberger, Plant Recovery Coordinator, PIFWO
Megan Laut, Recovery Program Manager, PIFWO

Methodology used to complete this 5-year review:

This review was conducted by staff of the Pacific Islands Fish and Wildlife Office (PIFWO) of the U.S. Fish and Wildlife Service (Service) beginning in October 2023. The review was based on a review of current, available information since the last 5-year review for *Solanum incompletum* (USFWS 2020). The evaluation by Daniel Adamski, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Megan Laut, Recovery Program Manager.

Background:

For information regarding the species' listing history and other facts, please refer to the Fish and Wildlife Service's Environmental Conservation On-line System (ECOS) database for threatened and endangered species (*http://ecos.fws.gov/ecp/species/3199*).

Review Analysis:

Please refer to the previous 5-year reviews for *Solanum incompletum* published in the Federal Register on January 18, 2008 (available at *https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/1156.pdf*), August 6, 2015 (available at *https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/2281.pdf*), and on September 28, 2020 (available at *https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/3121.pdf*) for a complete review of the species' status, threats, management efforts, and references cited. We are not aware of any significant new information regarding the species' biological status since listing to warrant a change in the Federal listing status of *S. incompletum*.

This short-lived perennial shrub in the Solanaceae (nightshade) family is endangered and found on the island of Hawai‘i, with historic occurrences on Lāna‘i and Maui. The status and trends for *Solanum incompletum* are provided in the tables below.

New Status Information:

- Currently, there are 106 wild individuals (66 mature and 40 immature) across five populations at Pōhakuloa Training Area (PTA), Pu‘uanahulu, and Pu‘uwa‘awa‘a on the island of Hawai‘i. (U.S. Army Garrison-Hawai‘i [USAG-HI] 2024).
- Currently, there are 58 founder lines represented in *ex situ* storage and propagation collections, including seeds in seed banks and plants in a nursery or living collection (Lyon Arboretum 2024; National Tropical Botanical Garden [NTBG] 2023; Volcano Rare Plant Propagation Facility [VRPPF] 2023; USAG 2024).

New Threats:

- None

New Management Actions:

- Monitoring and surveys—The Center for Environmental Management of Military Lands (CEMML) and the Department of Land and Natural Resources (DLNR) monitors fences, rodents, and plants, and collects cuttings of wild *Solanum incompletum* (USAG-HI 2024).
- CEMML conducted weed control around wild and reintroduced plants and maintains fuel breaks across PTA (USAG-HI 2024).
- CEMML controls aphids and scales using insecticidal soap, and controls ants with granular insect baits (USAG-HI 2024).
- Collection and propagation for genetic storage and reintroduction—
    - Lyon Arboretum reports 1336 seeds in storage representing four founders, and an additional 2,485 seeds representing six founders were used in germination trials (Lyon Arboretum 2024).
    - NTBG reports an unknown number of seeds in storage collected from three cultivated plants (NTBG 2023).
    - PTA Rare Plant Propagation Facility (PTA RPPF) reports 6,862 seeds in storage representing 54 wild founder plants (USAG-HI 2024).
    - VRPPF reports 10 potted plants in a living collection representing nine founders (VRPPF 2023).
    - Translocations—Reintroductions occurred at multiple sites between 2004 and 2014, and currently 371 reintroduced individuals remain across three sites (USAG-HI 2024).

Table 1. Status and trends of *Solanum incompletum* from listing through current 5-year review. Table 1a shows progress according to Interim Stabilization Goals; Table 1b shows progress according to Preventing Extinction Goals.

Table 1a.

Date	No. wild individuals	No. Outplanted	Stability Goals identified in Recovery Plan	Stability Goals Completed?
1994 (Listing)	2	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2008 (5-year review)	63 mature 20 immature	1,085 planted 921 survived	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2015 (5-year review)	86	554 (189 natural recruits)	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No

Table 1b.

Date	No. wild individuals	No. outplanted	*Preventing Extinction Targets identified by HPPRCC	*Preventing Extinction Targets Completed?
2020 (5-year review)	73–113	214 mature 195 immature	All threats managed in all 3 populations	Partially
			Reproduction (i.e., viable seeds, seedlings, saplings) at all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2025 (5-year review)	106	371	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			Natural reproduction at all 3 populations	No
			3 populations with 50 mature individuals each	Partially

* The Preventing Extinction Stage was established in 2011. Prior to 2011, the Interim Stabilization Stage was the first stage towards recovery (now it is the second stage after Preventing Extinction).

Table 2. Threats to *Solanum incompletum* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulate destruction and degradation of habitat and herbivory	A, C, D	Ongoing	Partial, enclosures constructed at PTA
Established ecosystem altering invasive plant species degradation of habitat	A, E	Ongoing	Nonnative plant control at PTA
Drought destruction and degradation of habitat	A	Ongoing	None
Fire destruction and degradation of habitat	A	Ongoing	Partial, non-native plant control and firebreaks at PTA
Climate change degradation and loss of habitat	A	Ongoing	Partial, reintroduction ongoing
Collection and vandalism impacts	B	Ongoing	None
Rodent predation and herbivory	C	Ongoing	Partial, PTA monitoring
Insect predation and herbivory	C	Ongoing	Partial, aphid, scale, and ant control at PTA
Military training activities	E	Ongoing	Partial, management of PTA
Loss of vigor due to low numbers	E	Ongoing	Partial, collection, propagation and reintroduction are ongoing

Synthesis:
Currently there are 106 wild individuals of *Solanum incompletum* on the island of Hawai‘i. Individuals are provided protection from ungulates by fencing, nonnative plant control, and insect control. Plant cutting collections, seed storage, and propagation are ongoing.

Stabilizing (interim) targets, and downlisting, and delisting criteria are provided in the Recovery Plan for the Multi-Island Plants (USFWS 1999), and recovery objective guidelines developed by the Hawai‘i and Pacific Plants Recovery Coordinating Committee (HPPRCC 2011). The HPPRCC identifies an additional initial objective, the Preventing Extinction Stage, in addition to the Interim Stabilization, Delisting, and Downlisting objectives. Furthermore, life history traits such as breeding system, population size fluctuation or decline, and reproduction type (sexual or vegetative), have been included in the calculation of goals for the number of populations and reproducing individuals for each stage. The goals for each stage remain grouped by life span defined as annual, short-lived perennial (fewer than 10 years), or long-lived perennial.

Solanum incompletum is a short-lived perennial shrub. To prevent extinction, which is the first milestone in recovering the species, the taxon must be managed to control threats (e.g., fenced) and have 50 individuals (or the total number of individuals if fewer than 50 exist) from each of three populations represented in *ex situ* (secured off-site, such as a nursery or seed bank) collections that are well managed. In addition, a minimum of a total of three populations should be documented on the island of Hawai‘i, and at least one other island (Maui, Lāna‘i) where they now occur or occurred historically and each of these populations must be naturally reproducing (i.e., viable seeds, seedlings) with a minimum of 50 mature, reproducing individuals per population.

The preventing extinction goals for this species have not been met. Currently, only two populations have more than 50 individuals, genetic storage is not complete, and all threats are not being managed (Table 1, Table 2). Therefore, *Solanum incompletum* meets the definition of Endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:
No significant new information regarding the species' biological status has been reported since the last 5-year review in 2020. Thus, the following recommendations for future actions are updated or reiterated for the 5-year review for 2025.

- Surveys and monitoring—
  - Continue to monitor known populations of *Solanum incompletum* to assess resiliency and make collections.
  - Continue surveys for populations of *Solanum incompletum* in areas of potentially suitable habitat.
  - Determine suitable locations for reintroductions.
- Ungulate monitoring and control—Construct fenced exclosures and construct new fences to protect individuals from the negative impacts of browsing by ungulates.
- Invasive nonnative plant monitoring and control—Control established ecosystem-altering nonnative invasive plant species, and those that compete with *Solanum incompletum.*
- Rodent control—Develop and implement effective strategies to control and reduce rodent predation of *Solanum incompletum.*
- Site and habitat protection—Develop and implement effective control measures to reduce the impact of destruction by military activities, drought, and insect predation.
- Fire prevention and control—Develop and implement fire prevention management plans.
- Climate change adaptation strategy—Research suitability of habitat for viability of species, including where to conduct translocations in the future due to the impacts of climate change.
- Captive propagation for genetic storage and reintroduction—Continue to maintain collection and propagation efforts for maintenance of genetic stock and for reintroduction.
- Build resiliency, redundancy, and representation — Increase species' viability through habitat restoration, threat control, and reintroduction and translocation

into suitable habitat that is being managed for known threats to this species to reduce impacts of reduced viability due to low numbers.

- Research—
  - Determine which species may act as pollinators and which may assist with fruit dispersal.
  - Conduct genetic studies to determine genetic variation within the population (and between populations) and plan an effective breeding program.
- Alliance and partnership development—Continue to work with partners and other land managers in planning and implementation of ecosystem-level restoration and management to benefit this species.

References:

[HPPRCC] Hawai‘i and Pacific Plants Recovery Coordinating Committee. 2011. Revised recovery objective guidelines. 8 pp.

Lyon Arboretum. 2024. Report on controlled propagation of listed species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawai‘i.

[NTBG] National Tropical Botanical Garden. 2023. Report on controlled propagation of listed species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawai‘i.

[USAG-HI] United States Army Garrison-Hawai‘i. 2024. U.S. Army Garrison Pōhakuloa Training Area Natural Resources Program FY 2022 to FY 2023 Biennial Report. Prepared by Center for Environmental Management of Military Lands, Colorado State University. June 2024. 558pp.

[USFWS] U.S. Fish and Wildlife Service. 1999. Recovery Plan for the Multi-Island Plants. Portland. 206 pp. + appendices.

[USFWS] 2008. *Solanum incompletum* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/1165.pdf*.

[USFWS] 2015. *Solanum incompletum* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/2281.pdf*.

[USFWS] 2020. *Solanum incompletum* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecosphere-*

documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/3121.pdf.

[USFWS] U.S. Fish and Wildlife Service. 2023. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status reviews for 133 Species in Oregon, Washington, Idaho, Montana, California, Hawaii, Guam, and the Northern Mariana Islands. Federal Register 88(56): 17611–17614, March 23, 2023.

[VRPPF] Volcano Rare Plant Propagation Facility. 2023. Report on controlled propagation of listed species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawai‘i.

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SIGNATURE PAGE for 5-YEAR REVIEW of *Solanum incompletum* (pōpolo kū mai)

Pre-1996 DPS listing still considered a listable entity? N/A

Recommendation resulting from the 5-year review:

_____ Delisting
_____ Reclassify from Endangered to Threatened status
_____ Reclassify from Threatened to Endangered status
__X__ No Change in listing status

For **Field Supervisor, Pacific Islands Fish and Wildlife Office**

_____ Date_____